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Impact of Grazing Corn Stalks in the Spring on Crop Yields

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Grazing corn residue in the spring had no detrimental effect on subsequent soybean yields and may slightly increase yields.

Summary

A two-year experiment was designed to determine the impact of grazing corn residue during the spring on subsequent soybean yields in a corn-soybean rotation. Tillage treatments consisting of ridge-till, fall-till, spring-till, and no-till were also evaluated to determine if yields could be maintained by alleviating compaction from grazing in the spring. Grazing treatments overall, and specifically in the ridge-till and no-till systems, resulted in increased yields. Residue cover was also more sensitive to changes in tillage rather than grazing; however, both treatments decreased residue cover.

Introduction

Traditional corn residue grazing occurs from November to February. Based on numerous research trials at the University of Nebraska Agricultural Research and Development Center, grazing corn residue during this period does not impact subsequent crop yields, whether corn or soybeans (1997 Nebraska Beef Report, pp. 34-37). While grazing corn residues decreases residue and increases bulk density of soil, presumably no impact is observed, because cattle were only maintained in crop fields while the ground was frozen (1997 Nebraska Beef Report, pp. 34-37).

However, producers require both holding areas and feed sources for cattle from February until pastures are available in late April. Fields generally are very wet and not frozen from February to April. Therefore, compaction from cattle may cause detrimental yield losses in subsequent crops. The objective of this study was to determine the impact from grazing corn residue from late February until late April on subsequent soybean yields.

Procedure

In 1997, a 90-acre field was identified. The field was split into quarters with ungrazed check strips replicated across each quarter. Crop production was based on an annual corn-soybean rotation with one-half of the field grown to each crop. The field was irrigated by a linear-move (2425 feet width) irrigation system (Valmont, Valley, Neb.) and the grazing areas replicated within each half grown to corn for grazing experiments. The grazing trials were conducted from Febr. 25 until April 14 in 1998 (48 days) and from March 1 until April 26 in 1999 (56 days). Animals were fed supplement daily at 1.5 lb per head per day. Calf stocking rate was approximately .8 acres per calf for 60 days. The stocking rate was based on average stocking rates to optimize animal performance. Some producers may use spring grazing areas as holding or calving pens where stocking rates are greater than .8 acres per calf.

Tillage treatments included ridge-tilling during the summer, no-tillage, fall tillage with a chisel followed by conventional tillage (disk) in the spring, or spring conventional tillage alone. All tillage treatments were conducted during the corn rotation with no tillage following the soybean crop. Grazed and ungrazed treatments were superimposed on tillage treatments. The no-till, ridge-till, and spring-till treatments each contained a grazed and ungrazed section. Treatments were applied to an eight-row strip and grazing treatments managed with electric wires. Residue cover was measured by determining residue at points in a transect across the eight-row treatment strip.

At harvest, the middle six rows were harvested out of the 8-row strip to maintain one border row on each side and eliminate effects from grazing pressure and fences. Soybean harvest was conducted with a 3300 John Deere combine with a 10-foot head. Each six-row strip

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was harvested in two passes, taking four rows first followed by two rows. After each individual replication (eight replications per treatment; seven treatments) was harvested, total weight was recorded using an experimental weigh wagon. Samples were collected at this time to determine DM and DM yield. Corn harvest (in 1999) was conducted with normal production equipment and all eight rows included in the replication. Weighing and sampling were performed similar to soybeans except a Brent 550 bu grain cart with J-star load cells was used for weighing.

Results

Animal performance

Calf performance was variable across years (Table 1). In 1998, calves gained 2.12 lb per day. In 1999, ADG was significantly less and calves just maintained weight during the 56 days (ADG = -.1lb per day). In 1998, calves were lighter, with initial weights of 612 lb as compared to 688 lb in 1999. However, final weights were not significantly different between years. When comparing performance based on field management, whether no-till or ridge-till, performance was not influenced ($P > .70$) and initial and final weights were similar. Gains were different across years based on residual corn grain in fields. In 1998, residual grain estimation from surrounding fields suggested that an average of 15 bu of corn grain per acre was available to calves. In 1999, no corn grain was available based on residual grain measurements.

Table 1. Animal performance of calves grazing corn residue in the spring.[a]

	Tillage treatment[b]		Year[c]		
Item	Ridge-till	No-till	98	99	SE
Initial weight, lb	645	655	612	688	17
Final weight, lb	693	703	714	683	18
ADG, lb	1.0	1.0	2.1	-.1	.13

[a]Stocking rates were approximately 1 calf per acre across tillage treatments and years.
[b]No effect of tillage treatment was observed ($P > .70$).
[c]Significant year effect was observed for IW and ADG ($P < .05$).

Crop production

Soybean yields the following fall after spring grazing were influenced by treatments ($P < .01$). Soybean yields on the grazed no-till areas tended to be greater than the ungrazed no-till and ungrazed ridge-till treatments ($P < .20$). Yield on the ridge-till grazed area was greater ($P < .05$) than all other treatments except the no-till grazed treatment ($P > .40$). Grazing from approximately Febr. 20 until April 20 did not depress soybean yields as was our original hypothesis. Based on these results, grazing improved subsequent soybean yields in the ridge-till and no-till management systems. Our hypothesis was that yields would potentially be depressed, but tillage treatments might help alleviate yield depressions due to soil compaction from spring grazing. Based on these results, spring and fall tillage caused a depression in yields relative to ridge-till and no-till grazed treatments.

Corn residue was influenced by both grazing and tillage treatments (Table 2). Based on measurements before grazing and after grazing, corn residue decreased in all treatments including ungrazed areas. In ungrazed areas, residue cover decreased by 13 to 18%. Fall tillage and spring tillage decreased residue as was expected. Fall tillage resulted in much lower initial cover (38%) and was lowest the following spring with only 23% cover. The no-till grazed treatment resulted in a 27% decrease and ridge-till grazing led to a 37% reduction in cover. Spring tillage (following grazing) decreased cover by approximately 55% for both grazed and ungrazed treatments. The tillage treatments appear to have much larger impacts on residue cover than grazing; however, both management factors decrease cover.

Due to the unstructured treatment design, contrasts were used to distinguish differences between treatment groups. Table 3 illustrates contrasts used and statistics for soybean yield and

Table 2. Effect of spring grazing and tillage treatments on residue cover before and after grazing and soybean yields the following fall.[a]

	Tillage:[b]	Ridge	Ridge	None	Fall/Spring	Spring	Spring	None	
	Grazing:	GR	UG	UG	UG	UG	GR	GR	
	Treatment:	1	2	3	4	5	6	7	
Item[c]								SE	F-test
Yield (lb)	329^{d}	319^{e,f}	318^{e,f}	314^{f}	316^{f}	319^{e,f}	326^{d,e}	3.8	.01
Yield (bu/acre)	59.3^{d}	57.3^{e,f}	57.2^{e,f}	56.5^{f}	56.9^{f}	57.2^{e,f}	58.5^{d,e}	.67	.04
Residue-B, %	82.5^{d}	83.7^{d,e}	90.2^{e}	37.8^{f}	89.4^{e}	86.9^{e}	89.5^{e}	1.5	.01
Residue-A, %	50.0^{d}	72.6^{e}	81.6^{f}	22.6^{g}	36.9^{h}	36.9^{h}	65.5^{e}	3.5	.01
Change, %	37.0^{d}	16.9^{e}	13.2^{e}	18.4^{e,f}	56.1^{g}	53.6^{g}	26.5^{f}	3.6	.01

[a]No significant year by treatment interaction was observed ($P > .90$). Yields were determined from 16 plots per treatment (8 plots per year) that ranged from .07 to .12 acres.
[b]Tillage treatments included ridge-till, no-till, fall tillage, and spring tillage. Superimposed on those were grazing (GR) and ungrazed (UG) treatments.
[c]Soybean yield measured in lb of DM and bushels per acre on a 90% air-dry basis, percent residue cover before (B) grazing and after fall tillage, percent residue cover after (A) grazing and spring tillage, and the change from before grazing to after in % cover by subtraction. Residue measurements after grazing and the subsequent change in residue are based on 1998 only.
[d,e,f,g,h]Means within a row with unlike superscripts differ ($P < .10$).

Table 3. Grazing and tillage impacts on soybean yields and residue cover.

Contrast	Treatments[a]	Yield (bu/acre) P=	Yield (bu/acre) means	Residue change (%) P=	Residue change (%) means
Grazed vs Ungrazed	1,6,7 vs 2,3,4,5	.01	58.4 vs 56.9	.01	38.3 vs 26.1
Ridge vs No-till	1,2 vs 3,7	.43	58.4 vs 57.9	.05	26.9 vs 18.3
Spring-till vs No-till	5,6 vs 3,7	.23	57.1 vs 57.9	.01	55.1 vs 18.3
No-till UG vs Tillage UG	3 vs 4,5	.60	57.2 vs 56.7	.01	13.2 vs 37.2
Ridge GR vs Ridge UG	1 vs 2	.04	59.3 vs 57.3	.01	37.0 vs 16.9
No-till GR vs No-till UG	7 vs 3	.14	58.5 vs 57.2	.01	26.5 vs 13.2

[a]Treatment numbers are: 1=Ridge-till grazed, 2=Ridge-till ungrazed, 3=No till ungrazed, 4=Fall/Spring till ungrazed, 5=Spring till ungrazed, 6=Spring till grazed, and 7=No till grazed.

change in residue cover. Comparing grazed to ungrazed treatments averaged across tillage treatments suggests grazing increases (P < .01) soybean yields by 1.5 bu per acre. Grazing corn residue in the spring also increased the amount of residue loss from 26 to 38%. Separating effect of grazing within ridge-till suggests grazing increased (P < .04) yields by 2.0 bu per acre. Grazing corn residue in the spring with no-till management tended (P < .14) to increase soybean yields as well. Based on the comparisons of ridge-till and fall/spring tillage with no-tillage, tillage did not influence soybean yields. Tillage and grazing both increased losses of residue cover over no-tillage and ungrazed treatments.

Corn yields two years after grazing in February of 1998, and harvesting beans in the fall of 1998 were recorded in 1999. No significant yield differences were observed.

In summary, spring corn residue grazing appears to have no detrimental impacts on subsequent soybean yields. Yields were statistically higher in grazed no-till and ridge-till treatments than the other treatments. Fall and spring tillage treatments had little impact on yields. Residue cover appears to be effected more by tillage treatments than grazing. Tillage also appears to “mask” any grazing effects on corn residue cover.

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